Sky Data with LSST Sensor in 2009

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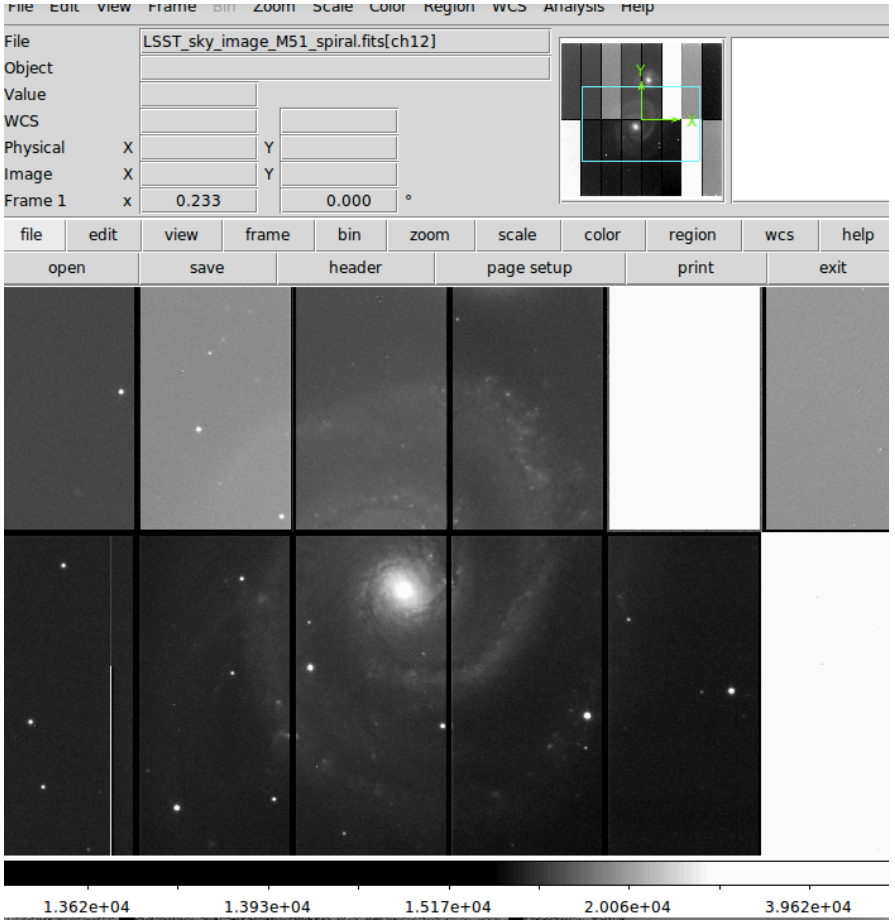
History

Data taken in 2009 and 2011 by O'Connor, Kotov, Haupt, Crotts et al at MDM Observatory (Kitt Peak)

- Sample image linked to the Useful Dataset page
- Took lots of astrometry data (tree rings, edges, dithering etc), available to interested parties

- Photo: MDM Observatory (Kitt Peak) 2.4m Hiltner Telescope in 2009



Astronomical data with LSST sensors

Early LSST prototypes:

13.5 μm pixels

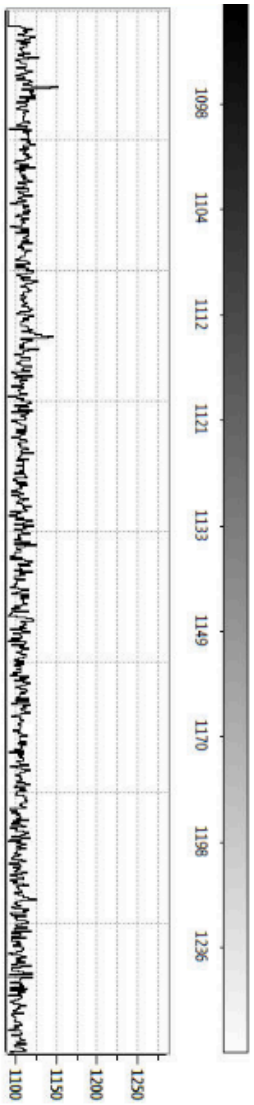
Plate scale 0.15”/pixel

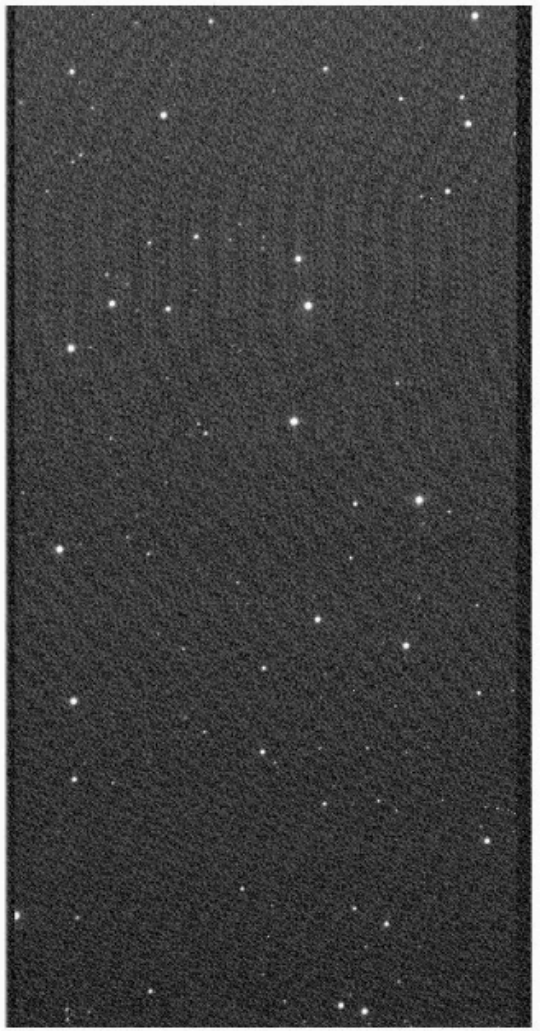
(LSST 0.2”/pixel)

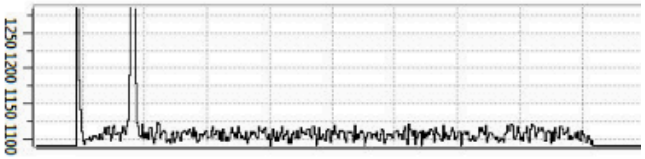
Looked at NGC7209 field

Same DM- and ngmix-based code used before for Fe55 and pinhole analysis

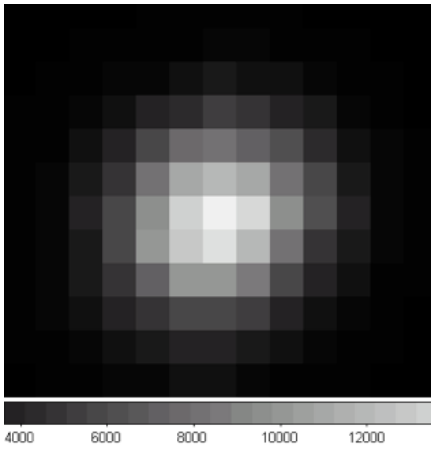
~ find 250 stars/ 40 sec exposure

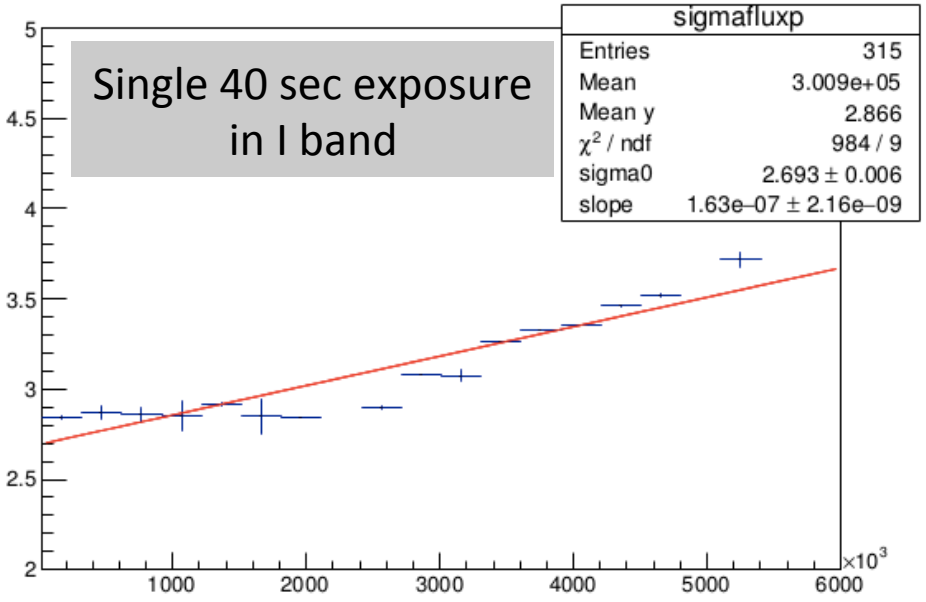






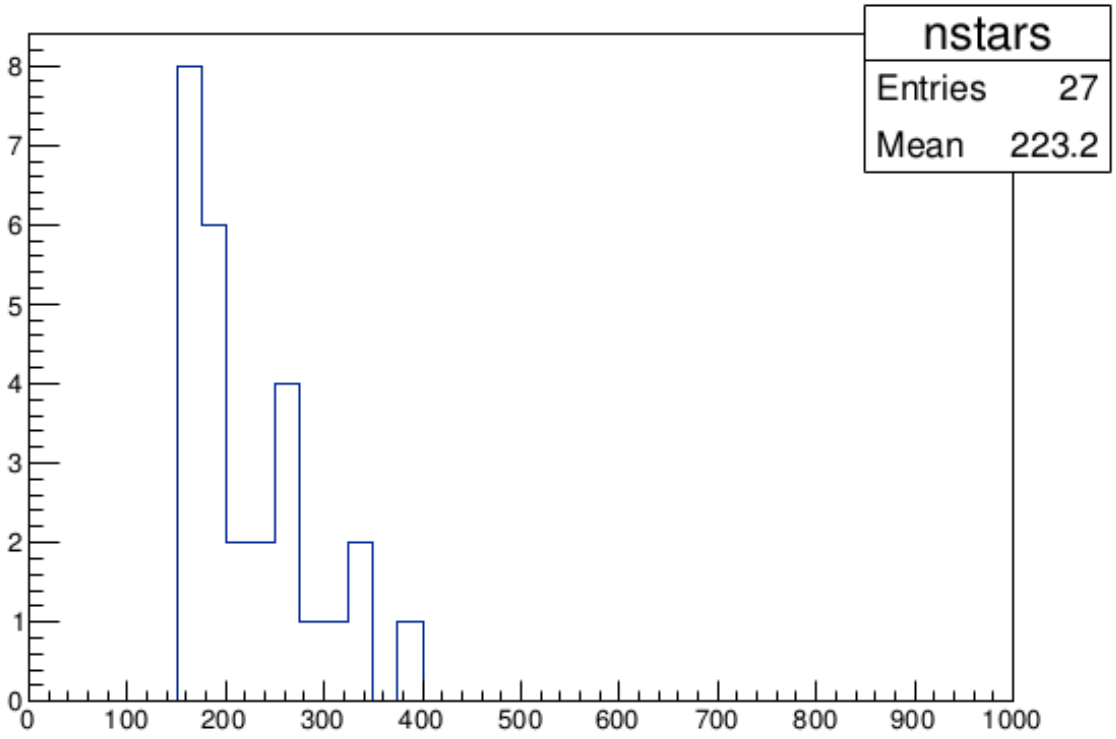
- Used long exposures (40 and 20 sec)
- Fit stars with 2D Gauss
- For each exposure: plot PSF of all objects in flux bins
- See B-F at a few % level over the whole dynamic range
  - Horizontal axis is total flux, need to redo this vs max pixel flux



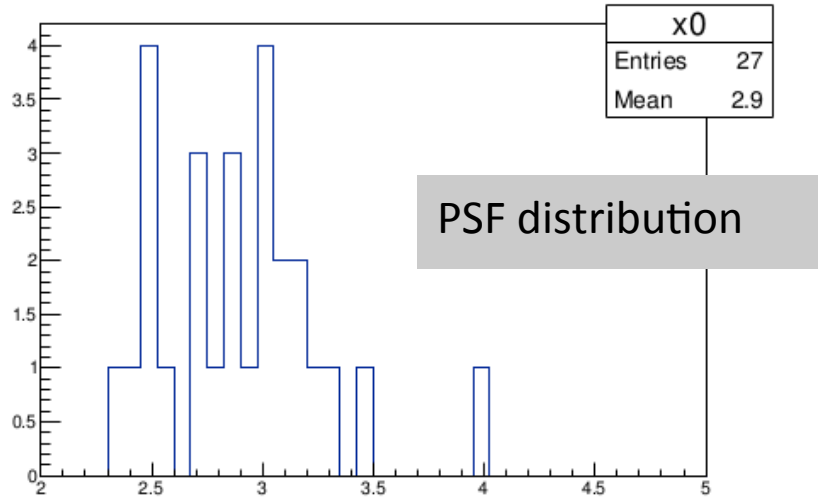


Selections

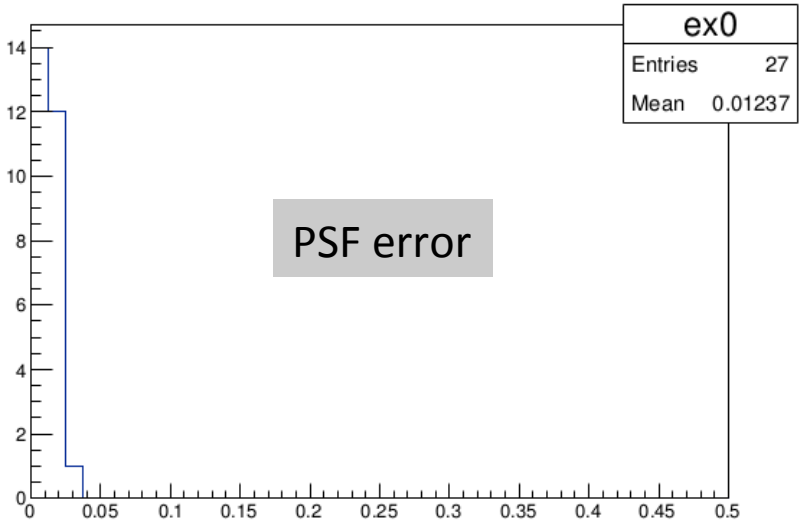
- Require Nmin > 150
- Have 27 exposures



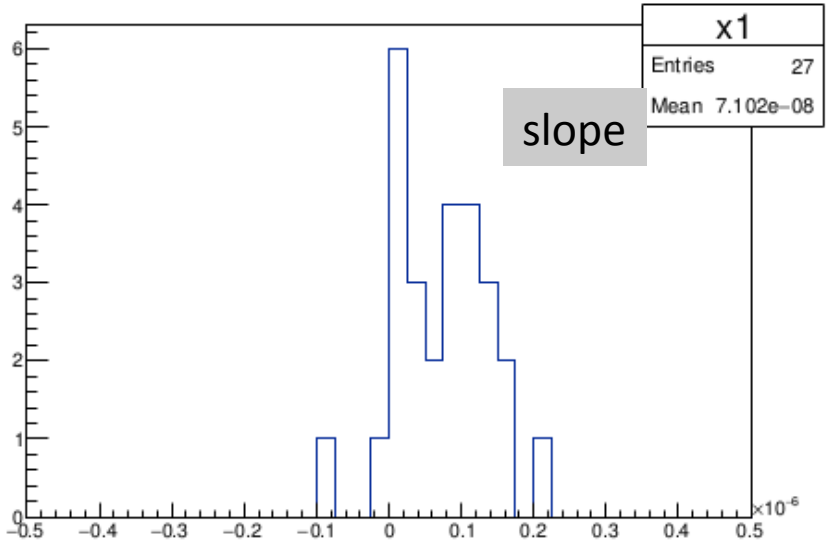
Sigma, slope & their errors



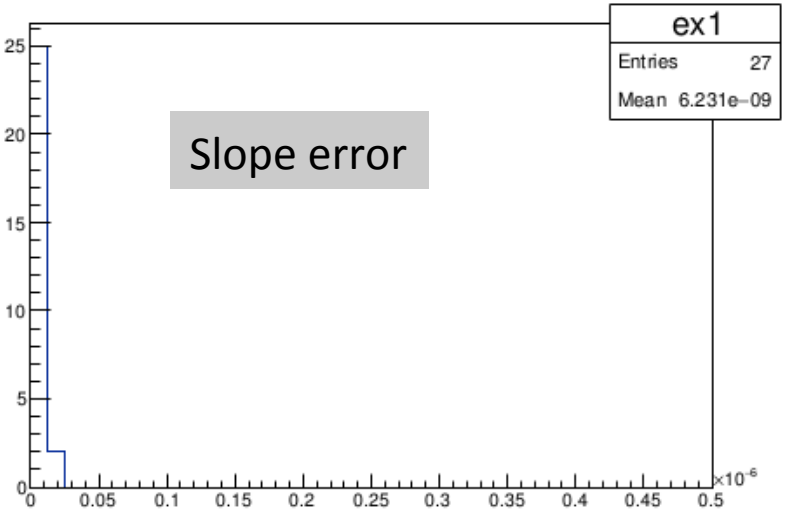
PSF distribution



PSF error



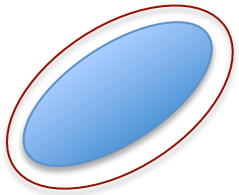
slope

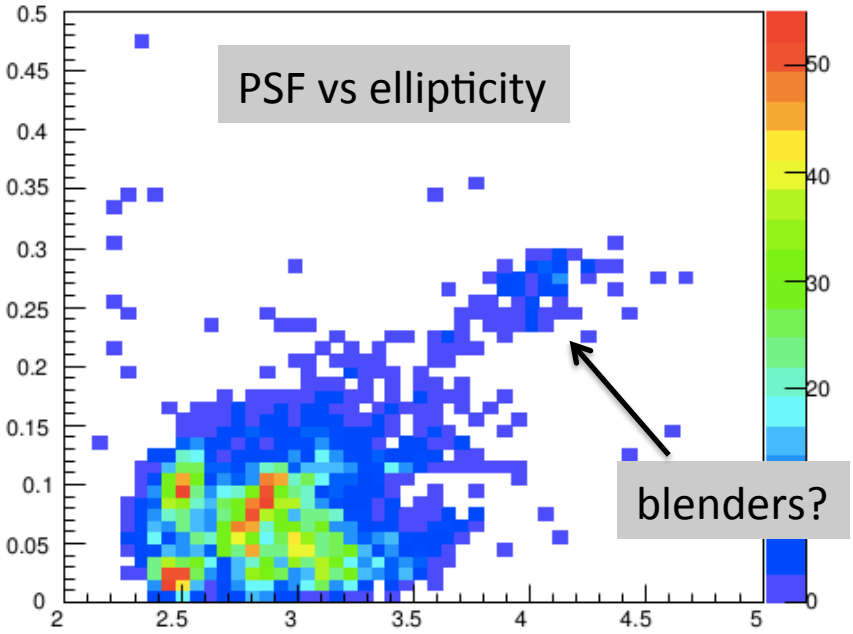


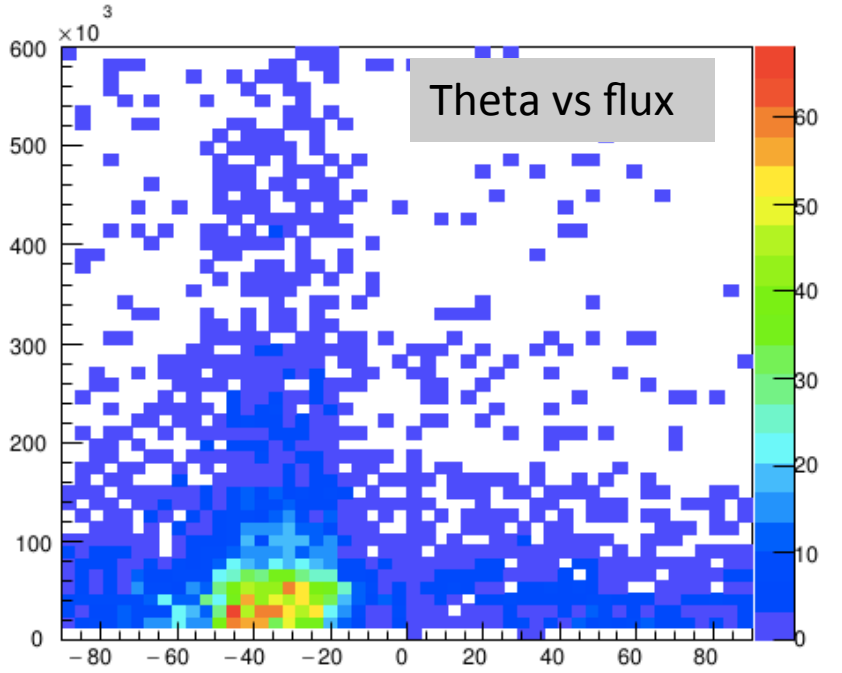
Slope error

Correlation plots: include all stars for exposures with >150 stars

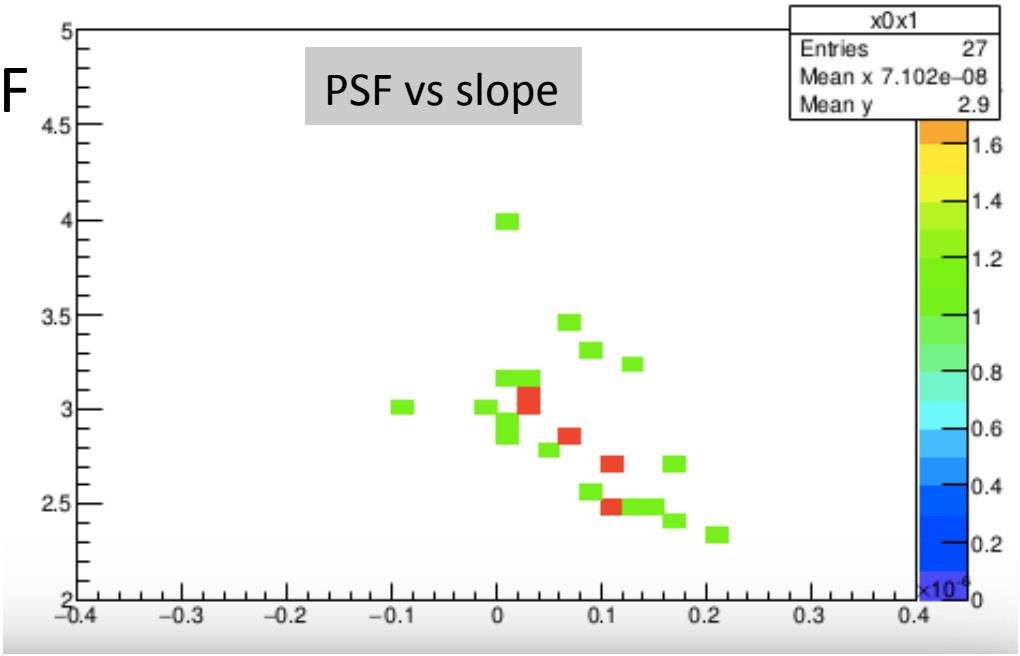
- Strong correlation in ellipticity direction

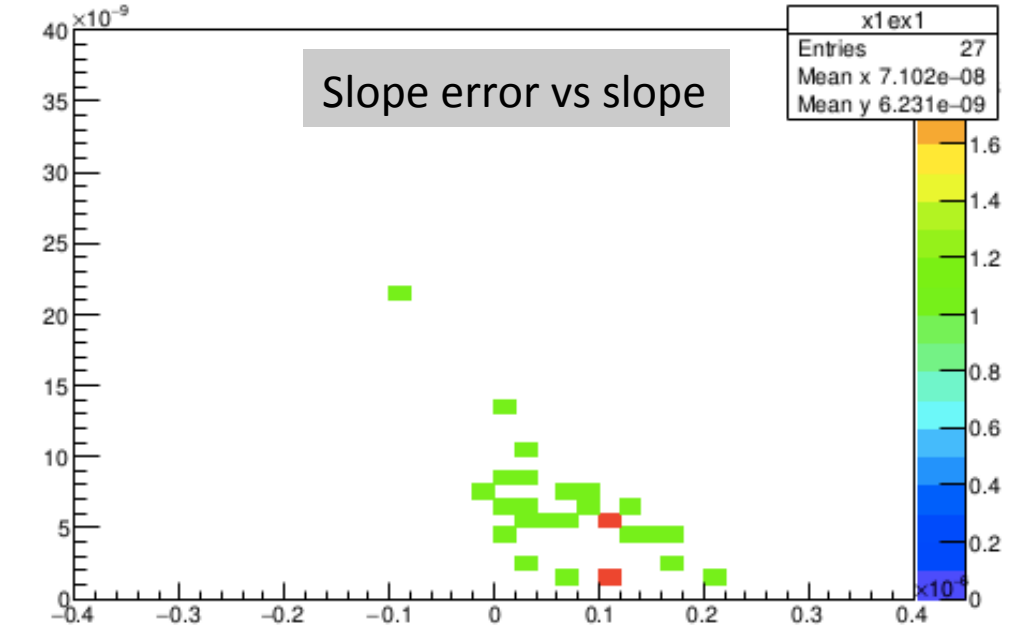






- Observe correlations, ex PSF vs slope, for different exposures
- Can it be described by *Astier et al 2014* and corrected as in *Gruen et al 2015*?
- Can it be simulated using physical model?
- Work in progress
- Will take more data in May at NOFS





MonoCam

- Part of DESC Science Road Map

US Naval Observatory Flagstaff Station (NOFS)

- Collaboration with Dave Monet
  - Dave's proposal: Primary interest is looking at known astrometric fields wherein the positions of a bunch of stars are known to 0.0001 arcsec, and do standard checks like rotating the CCD, changing exposure times, and similar.

have 2 telescopes that we would be interested in trying:

- 61-inch:
  - Scale is 13.5 arcsec/mm (LSST is 20 arcsec/mm)
  - 3-inch shutter
  - full set of 3x3-inch SDSS filters
  - Seeing 1.2 arcsec.

- 40-inch:
  - Scale is 40.0 arcsec/mm
  - corrected field of view of about 1.0 square degrees
  - 6-inch shutter
  - 6x6-inch SDSS filters (g,r,i,z), Johnson (U,B,V) and Kron-Cousins (R,I)
  - Seeing 1.5 arcsec.

- BNL has y filter – interesting measurement for thick CCDs (PSF, focusing, parallax, BF etc)

Studies

First priority:

- Astrometry
- Brighter Fatter: image dense star fields with different exposures
  - Large dynamic range in the same image
  - Stable setup (vibrations)
- Dithering

With good planning also:

- Atmospheric effects
  - Can do fast imaging of stars by shifting by 100 pixels (this takes only fraction of ms), expose, shift, expose etc
  - Compare to Phosim, others
- Photometry
  - Ultimate precision
  - Atmospheric effects
  - Exoplanets, strong lenses?
- Open to other suggestions

Setup and plans

- Will use BNL Lab 4 R&D setup, available for SAWG needs
  - Single CCD cryostat, LN cooled
  - Reflex (or ARCHON) controller
  - RTS2 software
  - Power, bias, temp controller etc
- Can install both e2v and ITL sensors
- NOFS will help with interfaces

- Agreed to take data in the first half of May 2016, contact us if interested
- Will start having dedicated meetings